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Optimizing the parameters of amoxicillin removal in a photocatalysis/ozonation process using Box–Behnken response surface methodology

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ABSTRACT

Concerns about environmental pollution from antibiotics such as amoxicillin have received increasing attention. These compounds should be eliminated from discharged effluents to avoid their possible negative effects on humans and animals, as well as on the environment. Recently, advanced oxidation techniques have been used to remove antibiotics. This work aims to study the removal of amoxicillin using a photocatalysis/ozonation process for treating pharmaceutical wastewater loaded with this type of refractory pollutants. The removal process was carried out using different pH values (3–11), catalyst dosages (250–750 mg/L), and reaction times (30–90 min), at an ozonation rate of 200 mg/h. Statistical analysis indicated that a quadratic model was suitable for modeling amoxicillin degradation by the photocatalytic process and that all studied parameters had statistically significant critical levels. Under optimum conditions (pH 11, a catalyst dose of 500 mg/L, and a reaction time of 90 min), the amoxicillin degradation efficiency of the photocatalytic process was 78.7%. The results of the photocatalysis/ozonation process indicated that after 90 min of ozone injection, an amoxicillin degradation efficiency of 98.7% was obtained. Therefore, it was concluded that the combined ozonation process and photocatalytic process could be used to remove amoxicillin effectively.

Keywords: Amoxicillin; Photocatalysis/ozonation reaction; Optimization; Box–Behnken; RSM

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